

## ROUND 15

### TOSS-UP

1) PHYSICS *Multiple Choice* In Rome in 1934, Enrico Fermi bombarded samples of uranium with neutrons. He thought the resulting radioactive products were evidence that he had:

- W) fissioned the uranium atoms
- X) fused the uranium atoms
- Y) created slow neutrons
- Z) created elements beyond uranium on the periodic chart

ANSWER: Z) CREATED ELEMENTS BEYOND URANIUM ON THE PERIODIC CHART

### BONUS

1) PHYSICS *Short Answer* Order the following from the LOWEST to the HIGHEST temperature: water boils, iron melts, ammonia boils, tin melts

ANSWER: AMMONIA BOILS, WATER BOILS, TIN MELTS, IRON MELTS

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### TOSS-UP

2) BIOLOGY *Multiple Choice* If the hormone ecdysone is inactivated in a monarch butterfly pupa, which of the following will occur:

- W) molting will occur immediately
- X) the chrysalis will rapidly develop into a larva
- Y) the mature butterfly will be sterile
- Z) molting will not occur

ANSWER: Z) MOLTING WILL NOT OCCUR

### BONUS

2) BIOLOGY *Multiple Choice* For each NADH generated in either the Krebs cycle or glycolysis:

- W) two PGAL molecules are converted to fructose 1,6-biphosphate
- X) three ATP molecules are generated in the electron transport system
- Y) three hydrogen are transported from the inner mitochondrial matrix to the outer matrix
- Z) ADP is hydrolyzed to cyclic-AMP

ANSWER: X) THREE ATP MOLECULES ARE GENERATED IN THE ELECTRON TRANSPORT SYSTEM

### TOSS-UP

3) CHEMISTRY *Multiple Choice* The most direct and accurate means for determining atomic and molecular weights is by:

- W) mass spectrometry
- X) nuclear magnetic resonance spectrometry
- Y) atomic absorption spectrometry
- Z) atomic force microscopy

ANSWER: W) MASS SPECTROMETRY

### BONUS

3) CHEMISTRY *Short Answer* The process that improves the quality of rubber by crosslinking polymer chains is called:

ANSWER: VULCANIZATION

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### TOSS-UP

4) ASTRONOMY *Multiple Choice* The idea of shepherding moons was proposed by Tremaine and Goldreich in 1979 to explain:

- W) anomalies in Saturn's rings discovered by Voyager 1
- X) the existence of some of Saturn's moons
- Y) anomalies in Saturn's rings discovered by Voyager 2
- Z) why rings of Uranus were so narrow

ANSWER: Z) WHY RINGS OF URANUS WERE SO NARROW

### BONUS

4) ASTRONOMY *Short Answer* For a telescope with a focal length of 5,000 millimeters and an eyepiece of 25 millimeters, what is the magnifying power of the telescope?

ANSWER: 200X (ACCEPT: 200)

(Solution:  $5000 / 25 = 200$ )

### TOSS-UP

5) MATH *Multiple Choice* Which of the following are NOT coterminal angles:

- W)  $90^\circ$  and  $-270^\circ$
- X)  $180^\circ$  and  $-180^\circ$
- Y)  $80^\circ$  and  $-190^\circ$
- Z)  $80^\circ$  and  $-280^\circ$

ANSWER: Y)  $80^\circ$  AND  $-190^\circ$

### BONUS

5) MATH *Short Answer* A thrill-seeking ice climber is climbing up a steep incline to fall off the top into a crevasse. It is quite slippery and each time he leaps forward 4 feet he slides back 1 foot. If he is 20 feet from the top how many leaps will it take him to fall off into the crevasse?

ANSWER: 7 LEAPS

(Solution: on the 7<sup>th</sup> leap he is at 21 feet, so he is over the edge;  $3+3+3+3+3+3+3=21$ )

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### TOSS-UP

6) EARTH SCIENCE *Multiple Choice* If the air has a dew point temperature of  $-4^\circ\text{C}$ , at what temperature would ice crystals form from the air:

- W)  $4^\circ\text{C}$
- X)  $-4^\circ\text{C}$
- Y)  $0^\circ\text{C}$
- Z)  $-2^\circ\text{C}$

ANSWER: X)  $-4^\circ\text{C}$

### BONUS

6) EARTH SCIENCE *Short Answer* Long, narrow, sandy islands lying parallel to an ocean coast and separated from it by a lagoon, are called:

ANSWER: BARRIER ISLANDS (DO NOT ACCEPT: BARRIER BEACHES, which needn't be islands)

### TOSS-UP

7) GENERAL SCIENCE *Short Answer* What woman, who lived in Egypt around 400 BC, is credited with the authorship of three major treatises on geometry and algebra, one on astronomy, and invented an instrument for distilling water, an instrument to measure the specific gravity of water, an astrolabe, and a planisphere?

ANSWER: HYPATIA

### BONUS

7) GENERAL SCIENCE *Multiple Choice* The human form of bovine spongiform encephalopathy is called:

- W) scabies
- X) Alzheimer's
- Y) Creutzfeldt-Jakob disease
- Z) prionitis

ANSWER: Y) CREUTZFELDT-JAKOB DISEASE

### TOSS-UP

8) GENERAL SCIENCE *Multiple Choice* In programming, a special type of data structure in which items are removed in the reverse order from that in which they are added, so the most recently added item is the first one removed, is called a:

- W) record
- X) array
- Y) stack
- Z) queue

ANSWER: Y) STACK

### BONUS

8) GENERAL SCIENCE *Short Answer* The rate at which each line on a CRT screen is drawn across the screen from top to bottom, and which affects what the human eye sees as flickering, is called the:

ANSWER: REFRESH RATE (ACCEPT: REFRESH)

### TOSS-UP

9) PHYSICS *Multiple Choice* Pure crystalline germanium is a good:

- W) electrical semiconductor
- X) electrical conductor
- Y) electrical insulator
- Z) transistor

ANSWER: Y) ELECTRICAL INSULATOR

### BONUS

9) PHYSICS *Short Answer* For a toaster that draws 12 amps on a 120 volt line, what is the resistance of the toaster?

ANSWER: 10 OHMS

(Solution:  $I = V/R$ ,  $R = V/I$ ,  $R = 120/12 = 10$ )

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### TOSS-UP

10) BIOLOGY *Multiple Choice* Which of the following is NOT an example of connective tissue:

- W) exocrine glands
- X) bone
- Y) blood
- Z) cartilage

ANSWER: W) EXOCRINE GLANDS

### BONUS

10) BIOLOGY *Multiple Choice* Which of the following would be least soluble in distilled water:

- W) progesterone
- X) glucose
- Y) ethanol
- Z) insulin

ANSWER: W) PROGESTERONE

(Solution: It is a steroid)

### TOSS-UP

11) CHEMISTRY *Multiple Choice* Of the following, which would be the most soluble in water:

- W) butanol
- X) pentanol
- Y) hexanol
- Z) heptanol

ANSWER: W) BUTANOL

### BONUS

11) CHEMISTRY *Short Answer* The atomic weight of gold is 197.0. If 1.5 moles of gold is needed to make a dental filling, how many grams, to the nearest whole number, of gold would be needed?

ANSWER: 295.5 GRAMS (ACCEPT: 295-296 GRAMS)

(Solution:  $1.5 \times 197.0$ )

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### TOSS-UP

12) ASTRONOMY *Multiple Choice* Which of the following is referred to as the Dog Star:

- W) Sirius
- X) Rigel
- Y) Polaris
- Z) Alpha Centauri

ANSWER: W) SIRIUS

### BONUS

12) ASTRONOMY *Short Answer* If the mass of gases collapsing in a nebulae are insufficient to initiate enough nuclear energy to become a main sequence star, it will usually become what type of star?

ANSWER: BROWN DWARF

### TOSS-UP

13) MATH *Multiple Choice* The universal set U contains the elements {1,2,3,4,5} (pronounced: data set 1,2,3,4,5). Set A contains the elements {1,3}. What elements does the set A' (read as: A prime) contain:

- W) {1, 2, 4}
- X) {2, 4, 5}
- Y) {1, 4, 5}
- Z) {3, 4, 5}

ANSWER: X) {2, 4, 5}

### BONUS

13) MATH *Short Answer* Simplify the expression:  $\frac{4!+3!}{5!}$  (read as: 4 factorial + 3 factorial divided by 5 factorial)

ANSWER:  $\frac{1}{4}$

(solution:  $= 3!(4 + 1) / (5 \times 4 \times 3!) = 5 / (5 \times 4) = 1/4$ )

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### TOSS-UP

14) EARTH SCIENCE *Multiple Choice* What would most likely result if the Earth's axis of rotation were tilted 10 degrees less than it now tilts?

- W) less difference between winter and summer in the Northern Hemisphere
- X) colder winters and warmer summers in the Northern Hemisphere
- Y) shorter days and longer nights at the Equator
- Z) warmer winters and warmer summers in the Northern Hemisphere

ANSWER: W) LESS DIFFERENCE BETWEEN WINTER AND SUMMER IN THE NORTHERN HEMISPHERE

### BONUS

14) EARTH SCIENCE *Short Answer* The property exhibited by certain minerals, such as sphalerite, which causes them to give off "flashes" of light when struck, is called?

ANSWER: TRIBOLUMINESCENCE

### TOSS-UP

15) GENERAL SCIENCE *Short Answer* In what continent does the AIDS epidemic affect the greatest proportion of the population?

ANSWER: AFRICA

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### BONUS

15) GENERAL SCIENCE *Multiple choice* Anthropologists most often infer brain shape from which of the following:

- W) presence of high zygomatic arch
- X) contours of fossil skulls
- Y) presence or absence of occipital bones
- Z) direct observation of preserved brains

ANSWER: X) CONTOURS OF FOSSIL SKULLS

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### TOSS-UP

16) GENERAL SCIENCE *Multiple Choice* What type of image, such as a true-type font, is created by a vector drawing process:

- W) bitmap
- X) pixel
- Y) object-oriented graphics
- Z) raster

ANSWER: Y) OBJECT-ORIENTED GRAPHICS

### BONUS

16) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT true of ROM:

- W) contains vital permanently stored information
- X) is non-volatile
- Y) it is sometimes referred to as main memory
- Z) with few exceptions, if an error occurs on the chip, it must be replaced

ANSWER: Y) IT IS SOMETIMES REFERRED TO AS MAIN MEMORY

### TOSS-UP

17) PHYSICS *Multiple Choice* Werner Heisenberg found that when the uncertainties in the determinations of position and momentum of a single particle are multiplied together, the product is approximately greater than or equal to:

- W) the speed of light
- X) the energy of a photon
- Y) Planck's constant
- Z) Avagadro's number

ANSWER: Y) PLANCK'S CONSTANT

### BONUS

17) PHYSICS *Short Answer* At 10 cents per kilowatt hour, how much does it cost to run an 1800 watt hair dryer for 2 hours?

ANSWER: 36 CENTS

(Solution: 1800 watts = 1.8 Kw...1.8 Kw x 2 hrs x 10 cents = 36 cents)

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### TOSS-UP

18) BIOLOGY *Multiple Choice* A sensory neuron is also referred to as which of the following:

- W) motor neuron
- X) interneuron
- Y) efferent (pronounced: EE-ferent) neuron
- Z) afferent (pronounced: A-ferent) neuron

ANSWER: Z) AFFERENT NEURON

### BONUS

18) BIOLOGY *Multiple Choice* If the Gram stain reveals a red-stained coccus, which of the following would most likely be true:

- W) it would not be sensitive to penicillin
- X) it would be acid-fast
- Y) it would possess the "Park-Peptide"
- Z) it would be motile

ANSWER: W) IT WOULD NOT BE SENSITIVE TO PENICILLIN

### TOSS-UP

19) CHEMISTRY *Multiple Choice* Which of the following is the formula for the hydronium (pronounced: HY-DRO-knee-um) ion:

- W) OH<sup>-</sup>
- X) H<sup>+</sup>
- Y) H<sub>3</sub>O<sup>-</sup>
- Z) H<sub>3</sub>O<sup>+</sup>

ANSWER: Z) H<sub>3</sub>O<sup>+</sup>

### BONUS

19) CHEMISTRY *Short Answer* The explosive TNT made from nitric acid is formally known as:

ANSWER: TRINITROTOLUENE

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### TOSS-UP

20) ASTRONOMY *Multiple Choice* It was not until the early 20<sup>th</sup> century that astronomers were able to distinguish true nebulae from:

- W) dark nebulae
- X) galaxies
- Y) comets
- Z) binary stars

ANSWER: X) GALAXIES

### BONUS

20) ASTRONOMY *Short Answer* Assume that the Hubble constant = 50 km/sec/megaparsec. How far away, in megaparsecs, is a galaxy whose red shift is 40,000 km/sec?

ANSWER: 800 MEGAPARSECS

(Solution:  $d = v/H_0; = 40,000/50 = 800$ )

### TOSS-UP

21) EARTH SCIENCE *Multiple Choice* Which of the following is NOT true of an El Nino:

- W) a pool of warm ocean water moves eastward to the central pacific
- X) geologic records of past El Nino events are obtained by analysis of growth layers in living coral
- Y) rainfall greatly increases in the mid-Pacific
- Z) it recurs erratically, but on average every 40 years

ANSWER: Z) IT RECURS ERRATICALLY, BUT ON AVERAGE EVERY 40 YEARS

(Solution: ...every 4 years)

### BONUS

21) EARTH SCIENCE *Short Answer* What glassy igneous rock is sometimes age dated by measuring the thickness of the hydrated layer that slowly forms on freshly exposed surfaces:

ANSWER: OBSIDIAN

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### TOSS-UP

22) GENERAL SCIENCE *Multiple Choice* Which of the following is the best example of “statistical inference”:

- W) estimating population parameters from statistical data
- X) measuring a sample from a population
- Y) calculating a mean from a set of data which has a high variance
- Z) calculating data from random sample

ANSWER: W) ESTIMATING POPULATION PARAMETERS FROM STATISTICAL DATA

### BONUS

22) GENERAL SCIENCE *Multiple choice* Which of the following is the accepted definition of a superacid:

- W) an acid system stronger than 100% sulfuric acid
- X) an acid system stronger than 100% nitric acid
- Y) an acid system stronger than a pH of 1
- Z) an acid system a hydrogen ion concentration of  $10^{14}$

ANSWER: W) AN ACID SYSTEM STRONGER THAN 100% SULFURIC ACID

### TOSS-UP

23) PHYSICS *Multiple Choice* Van de Graaff generators are capable of producing:

- W) only low voltages
- X) high enough voltages for x-ray equipment
- Y) only small sparks
- Z) voltages many times greater than the average lightening bolt

ANSWER: X) HIGH ENOUGH VOLTAGES FOR X-RAY EQUIPMENT

### BONUS

23) PHYSICS *Short Answer* What specific law most directly dictates that no heat engine can convert all its heat energy into mechanical energy:

ANSWER: THE SECOND LAW OF THERMODYNAMICS

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### TOSS-UP

24) BIOLOGY *Multiple Choice* In addition to the number of offspring produced at each birth and parental life span, what is the main determinant of biotic potential in a mammalian species:

- W) number of male offspring
- X) number of female offspring
- Y) number of males in the population
- Z) age of the female parent at first reproduction

ANSWER: Z) AGE OF THE FEMALE PARENT AT FIRST REPRODUCTION

### BONUS

24) BIOLOGY *Multiple Choice* If Loci (pronounced: LOW-cye) are very close together along a chromosome, there will be:

- W) a greater chance for crossing over
- X) a decreased chance for crossing over
- Y) no chance for crossing over
- Z) crossing over at an unpredictable frequency

ANSWER: X) A DECREASED CHANCE FOR CROSSING OVER

### TOSS-UP

25) CHEMISTRY *Multiple Choice* Which of the following are NOT examples of intermolecular forces:

- W) hydrogen-bond forces
- X) covalent-bond forces
- Y) London-dispersion forces
- Z) dipole-dipole forces

ANSWER: X) COVALENT-BOND FORCES

### BONUS

25) CHEMISTRY *Short Answer* In the common alkaline battery, what metal is oxidized in the anode reaction?

ANSWER: ZINC (ACCEPT: Zn)